$$= a \sin(\omega t - \underbrace{\frac{2\pi x}{\lambda} + \varphi_s}_{\varphi_M})$$

$$\varphi_M - \varphi_s = -\frac{2\pi x}{\lambda} = -\frac{\pi}{2} - 2k\pi$$

$$\frac{2x}{\lambda} = \frac{1}{2} + 2k$$

$$\boxed{x = (k + \frac{1}{4})\lambda}$$

$0 < x < l$

$$0 < k + \frac{1}{4}\lambda < l$$

$$-\frac{1}{4} < k < \frac{l}{\lambda} - \frac{1}{4}$$

$-0,25 < k < 4,75$

$0 \le k \le 4 \Rightarrow \exists$ 5 pts

| k | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| X(m) | 5 | 25 | 45 | 65 | 85 |

**4**

1)a- $x_F = Vt_1 \Rightarrow V = \frac{x_F}{t_1} = \frac{8 \times 3.10^{-3}}{0,04} = 0,6 m.s^{-1}$

b- $\lambda = 4 \times 3mm = 12mm$

$V = \frac{\lambda}{T} = \lambda N \Rightarrow N = \frac{V}{\lambda} = 50Hz$

2) $y_s(t) = a \sin(\omega t + \varphi_s)$

$a = 2mm$

$\omega = 2\pi N = 100\pi rad.s^1$

A la date $t_1$ $y_s = 0 \Rightarrow \sin(\omega t_1 + \varphi_s) = 0$

$\Rightarrow \omega t_1 + \varphi_s = 0$ ou $\omega t_1 + \varphi_s = \pi$ or d'après le graphe $V_s(t_1) < 0$

$\Rightarrow \omega t_1 + \varphi_s = \pi \Rightarrow \varphi_s = \pi - \omega t_1$; AN $\varphi_s = \pi - 100\pi \times 4.10^{-2} = -3\pi$

$\Rightarrow \varphi_s = \pi$

$d'où\ y_s(t) = 2.10^{-3} \sin(100\pi t + \pi)$

Qarray.tn -Aqra Blech- Qarray.tn